IZYUMOV, Yu.A.

Time formalism in the Born approximation theory of neutron scattering by a substance. Fiz. met. i metalloved. 11 no. 5:801-803 My '61. (MIRA 14:5)

1. Institut fiziki metallov AN SSSR.
(Neutrons--Scattering)

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S/126/61/012/001/003/020
E032/E414

AUTHOR: Izyumov, Yu.A.

TITLE: On various methods in the theory of ferromagnetic resonance

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.12, No.1, pp.20-29

TEXT: The present paper gives a review of the three methods which can be used to compute the ferromagnetic resonance line-width for small amplitudes of the radio frequency field. These methods are: 1) the transport equation method, 2) perturbation theory and 3) the method based on the statistical Green functions. All the calculations have been concerned with the case of the spin-phonon interaction which has frequently been discussed in the literature (Ref.1: A.I.Akhiyezer, J.Phys.USSR, 1946, 10, 217; Ref.5: A.I.Akhiyezer, B.G.Bar'yakhtar, S.V.Peletminskiy, ZhETF, 1959, 36, 216; Ref.6: M.I.Kaganov, V.M.Tsukernik, ZhETF, 1959, 36, 224). The analysis is therefore based on the Hamiltonian for the interaction between spin waves and phonons which, in the second quantization representation, can be written down in the form

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The Kubo (perturbation theory) and Green function methods have the advantage, however, that they can, in principle, provide higher approximations also. Moreover, they can provide the shift of the resonance frequency and the line form. In general, the part of the ferromagnetic resonance line-width which is due to the interaction of spin waves with phonons is determined by the damping constant with which the average number of spin waves with zero effective momentum approaches its equilibrium value. This constant can also be looked upon as a time correlation parameter between the creation and annihilation of the spin wave. Acknowledgments are made to Professor S.V.Vonsovskiy, Ye.A.Turov, G.V.Skrotskiy, A.A.Kokin and G.G.Taluts for discussions. There are 11 references: 6 Soviet and 5 non-Soviet. The four references to English language publications read as follows: Abrahams E. Phys.Rev., 1955, 98,387;
Kubo R., Tomita K.J. Phys.Soc.Japan, 1954, 9, 888;
Toyozawa V. Progr. Theor. Phys., 1958, 20, 53;
Kubo R. J.Phys.Soc.Japan, 1957, 12, No.6.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)

SUBMITTED: September 16, 1960

Card 3/3

26715
S/056/61/041/005/030/038
B102/B138

24.2200 (1144, 1147, 1160)

AUTHORS: Izyumov, Yu. A., Maleyev, S. V.

TITLE: Scattering of polarized neutrons in ferromagnetic and antiferromagnetic materials

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 5(11), 1961, 1644 - 1648

TEXT: In a previous paper (ZhETF, 40, 1224, 1961) Maleyev showed that slow unpolarized neutrons are magnetically scattered in ferromagnetic materials. Part of the cross section is due to inelastic magnetic scattering and part to magnetic-vibrational scattering. These terms are investigated in the present paper also, but for the case of polarized neutrons, when the polarization vector not only varies in value but may also rotate. It is shown how the parts of the cross section which are due to inelastic magnetic and magnetic-vibrational scattering can, for a given direction, be separated. For ferromagnetic materials the neutron polarization vector after scattering is defined by $\vec{P} = \mathrm{Sp}\, f^{+}\vec{\sigma} f\varrho / \mathrm{Sp}\, f^{+} f\varrho$, where

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scattering and interference between nuclear and magnetic scattering, and the vector of polarization due to inelastic magnetic scattering. The polarization vector for incoherent nuclear scattering of the neutrons is given by

$$\mathbf{P}_{\text{нек}} = \mathbf{P}_0 \frac{\overline{|A_l|^2} - |\overline{A}_l|^2 - \frac{1}{12}\overline{|B_l|^2 I_l(I_l+1)}}{\overline{|A_l|^2} - |\overline{A}_l|^2 + \frac{1}{4}\overline{|B_l|^2 I_l(I_l+1)}}. \tag{4}$$

for scattering without change of the magnetic state of the scatterer:

$$\begin{aligned}\mathbf{P}_{nm} = {} & \{\mathbf{P}_0|\overline{A}_l|^2 - 2\gamma r_0 F(q)\langle S_z\rangle(\mathrm{Re}\,\overline{A}_l\mathbf{M} + \mathrm{Im}\,\overline{A}_l[\mathbf{MP}_0]) + \\ & + \gamma^2 r_0^2 F^2(q)\langle S_z^2\rangle[2\mathbf{M}(\mathbf{MP}_0) - \mathbf{P}_0 M^2]\}(|\overline{A_l}|^2 - \\ & - 2\gamma r_0 F(q)\langle S_z\rangle\,\mathrm{Re}\,\overline{A}_l(\mathbf{MP}_0) + \gamma^2 r_0^2 F^2(q)\langle S_z^2\rangle M^2)^{-1},\end{aligned} \tag{5}$$

with $\vec{M} = \vec{m} - (\vec{e}\vec{m})\vec{e}$, where $\vec{m}$ is the unit vector in the direction of magnetization of the scatterer, $\langle S_z\rangle$ is the mean atomic-spin projection on to the direction of magnetization, $\langle S_z\rangle^2 = \langle S_z^2\rangle$. The polarization vector for scattering with emission (+) or absorption (-) of a spin wave is given by

$$\mathbf{P}_m^{\pm} = \frac{\mp 2\mathbf{e}(\mathbf{em}) + 2\mathbf{M}_x(\mathbf{M}_x\mathbf{P}_0) + 2\mathbf{M}_y(\mathbf{M}_y\mathbf{P}_0) - \mathbf{P}_0(M_x^2 + M_y^2)}{1 + (\mathbf{em})^2 \pm 2(\mathbf{P}_0\mathbf{e})(\mathbf{em})}. \tag{7}$$

$\sigma_{nm}(\vec{n},\vec{P}_0)$, $\sigma_m(\vec{n},\vec{P}_0)$ and $\sigma_n(\vec{n},\vec{P}_0)$ and also $\sigma_n(\vec{n})$ and $\sigma_m(\vec{n})$. For scattering in antiferromagnetic materials $\vec{P}_{incoh} = \alpha\vec{P}_0$ with

$$\alpha = \frac{\sum\{(\overline{|A_l|^2} - |\overline{A}_l|^2) - \frac{1}{12}\overline{|B_l|^2 I_l(I_l+1)}\}e^{-2W_l}}{\sum\{(\overline{|A_l|^2} - |\overline{A}_l|^2) + \frac{1}{4}\overline{|B_l|^2 I_l(I_l+1)}\}e^{-2W_l}}, \qquad (12)$$

for elastic scattering. In coherent nuclear scattering there is no change in polarization. The vector of polarization due to scattering without change of the magnetic state of the scatterer is given by $\vec{P}_{mo} = 2(\vec{M}\vec{P}_0)\vec{M}/M^2 - \vec{P}_0$ with $\vec{M} = \vec{m} - (\vec{e}\vec{m})\vec{e}$ for an antiferromagnetic with two sublattices. When, during scattering, the number of spin waves is changed by one,

$$\mathbf{P}_{m1} = 2\,\frac{\mathbf{P}_{0\perp} - \mathbf{e}_{\perp}(\mathbf{P}_0\mathbf{e}) + \mathbf{e}(\mathbf{e}\mathbf{m})(\mathbf{M}\mathbf{P}_0)}{1 + (\mathbf{e}\mathbf{m})^2} - \mathbf{P}_0, \qquad (16)$$

holds. $\vec{P}_{0\perp}$ and $\vec{e}_{\perp}$ are components of $\vec{P}_0$ and $\vec{e}$, $\vec{P}_{0\perp} = \vec{P}_0 - (\vec{P}\vec{m})\vec{m}$. With

$$\mathbf{P} = \frac{\alpha\sigma_{\text{нек}}(\mathbf{n})\,\mathbf{P}_0 + \sigma_{m0}(\mathbf{n})\,\mathbf{P}_{m0} + \sigma_{m1}(\mathbf{n})\,\mathbf{P}_{m1}}{\sigma_n(\mathbf{n}) + \sigma_{m0}(\mathbf{n}) + \sigma_{m1}(\mathbf{n})}, \qquad (17)$$

S/181/62/004/001/034/052
B104/B102

AUTHORS: Izyumov, Yu. A., and Noskova, L. M.

TITLE: Effective magnetic moment of an atom of a transition metal in a dilute alloy with a common metal

PERIODICAL: Fizika tverdogo tela, v. 4, no. 1, 1962, 217 - 224

TEXT: The authors calculate the effective magnetic moment of a paramagnetic atom in an MnCu-type alloy when exchange interaction between atom and conduction electrons are taken into account:

$$M_s = \frac{g^2\mu_0^2}{3kT} s(s+1)\left\{1 + \frac{3}{4}\frac{N_s}{N}\frac{I_0}{\zeta}\right\}H + N_s\frac{3}{2}\frac{\mu_0^2 H}{\zeta}. \quad (22)$$

Here μ_0 is Bohr's magneton, g is the Landé factor of the ion, N_s is the number of conduction electrons in the crystal, N is the number of the lattice sites, I_0 is the parameter of the exchange interaction of the paramagnetic atom with the conduction electrons, ζ is the Fermi end point energy.

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S/181/62/004/001/035/052
B104/B102

AUTHOR: Izyumov, Yu. A.

TITLE: Magnetic scattering of slow neutrons in dilute alloys of a transition metal with a common metal

PERIODICAL: Fizika tverdogo tela, v. 4, no. 1, 1962, 225 - 230

TEXT: Proceeding from

$$\frac{d^2\sigma}{d\Omega dE_{p'}} = \frac{m^2}{(2\pi)^3 \hbar^5} \frac{p'}{p} \int_{-\infty}^{+\infty} dt e^{\frac{i}{\hbar}(E_{p'} - E_p)t} \overline{\langle V^+_{p'p} V_{p'p}(t) \rangle}, \quad (1)$$

and using the formalism of the scattering theory the author calculated the effective transverse slow-neutron scattering in MnCu-type alloys. Restrictinghimself to elastic magnetic scattering he obtains

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$$\rho_{\pm}(\mathbf{r}) = \sum_{\mathbf{k}}^{k_0^{\pm}} |\psi_{\mathbf{k}(\pm)}(\mathbf{r})|^2;$$

$$\psi_{\mathbf{k}(\pm)}(\mathbf{r}) = \psi_{\mathbf{k}}^0 \pm \frac{1}{N} \sum_{\mathbf{k}'}^{k_0^{\pm}}{}' \frac{J(\mathbf{k}\mathbf{k}')}{\varepsilon_{\mathbf{k}} - \varepsilon_{\mathbf{k}'}} \psi_{\mathbf{k}'}^0 \sum_{n} e^{i(\mathbf{k}-\mathbf{k}')\mathbf{R}_n} S_n^z. \qquad (13)$$

for the transverse elastic neutron scattering into the unit solid angle after integrating over the scattered neutron energies. These equations are discussed in detail. It is demonstrated that due to the interaction of the spin-unsaturated atom shells of the transition metal with the conduction electrons the effective magnetic form factor of an atom changes considerably. This form factor can be determined both in ferromagnetic and in paramagnetic alloys from the neutron scattering. The symbols in the equations $(p_1 E_p)$ and $(p' E_{p'})$ denote momentum and energy of a neutron in the original and the scattered beam, m is the neutron mass, $V_{p'p}$ is the interaction operator of a neutron with the scatterer, $V_{p'p}(t)$ is the same operator in the Heisen-

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S/056/62/042/006/041/047
B104/B112

AUTHOR: Izyumov, Yu. A.

TITLE: Scattering of polarized neutrons by a helicoidal magnetic structure

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 6, 1962, 1673-1675

TEXT: V. G. Bar'yakhtar et al. (report delivered at the Kourovka Symposium, 1962), who investigated the elastic scattering of neutrons by helicoidal structures, showed that the distance between two purely magnetic maxima in the neutron diffraction picture is clearly related to the angle of rotation of two neighboring spins of the helicoid. The difficulties encountered in interpreting the neutron diffraction picture are caused by the scattering of non-polarized neutrons. The scattering cross section of the neutrons which have an initial polarization of $\vec{p}_0$ and are elastically scattered into the unit solid angle in the $\vec{n}$ direction is the sum of a cross section of neutrons undergoing pure

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S/053/62/077/003/001/002
B101/B144

AUTHORS: Vonsovskiy, S. V., Izyumov, Yu. A.

TITLE: Electron theory of transition metals. I

PERIODICAL: Uspekhi fizicheskikh nauk, v. 77, no. 3, 1962, 377-448

TEXT: A report based upon Western and Soviet publications is given on the present knowledge concerning the electron structure of the atoms of transition metals, on the electron properties of transition metals, the general conceptions of the electron structure of crystals containing atoms of transition metals, and on the band model and s-d(f) exchange model of the crystals of transition metals. Mutual approach of conceptions of the band and s-d models is said to be the next task of further theoretical development. There are 7 figures, 10 tables, and 189 references.

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IZYUMOV, Yu. A.

"Neutron Dispersion in Magnetic Materials"

report submitted for the Conference on Solid State Theory, held in Moscow, December 2-12, 1963, sponsored by the Soviet Academy of Sciences.

S/181/63/005/003/003/046
B102/B180

AUTHOR: Izyumov, Yu. A.

TITLE: Green functions method in the theory of the ferromagnetism

PERIODICAL: Fizika tverdogo tela, v. 5, no. 3, 1963, 717-723

TEXT: The method of describing ferromagnetics by advanced and retarded two-time Green functions was developed by Bogolyubov and Tyablikov (e. g. DAN SSSR, 126, 53, 1959; cf. also Phys. Rev. 127, 88, 1962) and is now generalized for substances of any magnetic structure and atomic spin, in a wide temperature range. It is based on a cutoff of the infinite chain of equations for the Green functions. By analogy with the second-quantization approximation, at a certain stage a C-number is assumed for the spin operator projection onto the equilibrium spin direction. The equilibrium position of the spin operator is assumed to be given for each lattice site at T=0. The problem is to determine the $\langle S_g^{\prime +} S_l^{\prime -} \rangle$ quantities required to find the mean energy of the magnetic substance at given temperature. The basis is the Hamiltonian

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Green functions method in the theory ... S/181/63/005/003/003/046
B102/B180

$$H=-\sum_{ij} J_{ij} \sum_{\xi\eta} D_{ij}^{\xi\eta} S_i'^{\xi} S_j'^{\eta} \quad (\xi, \eta=+, -, z), \qquad (7)$$

where besides $S_i'^{\beta}$ the usual components of the spin vectors (defined in the local system of coordinates and connected by

$$S_i^{\alpha}=\sum_{\beta} d_i^{\alpha\beta} S_i'^{\beta} \quad (\alpha, \beta=x, y, z), \qquad (5)$$

with the spin vector components S_i^{α} in the general system) circular projections

$$S_i'^{\pm}=S_i'^{x} \pm i S_i'^{y},$$

are also introduced. This has already been done for $s=1/2$. For arbitrary $s>1/2$, considered here, the problem is more difficult. When the Green function is represented by $\langle\langle S_g'^{+} | X_1 \rangle\rangle$, where X_1 is a certain combination of the spin operators at site 1, the chain of equations for the Green functions can be closed by introducing the approximation relation

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$$\langle\langle S_f^{\pm} S_i^{z} | X_l \rangle\rangle = \langle S_i^{z} \rangle \langle\langle S_f^{\pm} | X_l \rangle\rangle, \tag{9}$$

i. e. by taking the z-projection as a C-number. Then the system of equations to be solved becomes

$$\left.\begin{aligned}
&\Big[E - 2\sum_i J_{if} D_{fi}^{zz} \langle S_i^z \rangle\Big] \langle\langle S_f^+ | X_l \rangle\rangle = \frac{1}{2\pi} \langle [S_f^+, X_l] \rangle - \\
&- 4 \langle S_f^z \rangle \sum_i J_{if} D_{fi}^{-+} \langle\langle S_i^+ | X_l \rangle\rangle - 4 \langle S_f^z \rangle \sum_i J_{if} D_{fi}^{--} \langle\langle S_i^- | X_l \rangle\rangle; \\
&\Big[E + 2\sum_i J_{if} \dot{D}_{fi}^{zz} \langle S_i^z \rangle\Big] \langle\langle S_f^- | X_l \rangle\rangle = \frac{1}{2\pi} \langle [S_f^-, X_l] \rangle + \\
&+ 4 \langle S_f^z \rangle \sum_i J_{if} \dot{D}_{fi}^{-+} \langle\langle S_i^- | X_l \rangle\rangle + 4 \langle S_f^z \rangle \sum_i J_{if} \dot{D}_{fi}^{--} \langle\langle S_i^+ | X_l \rangle\rangle.
\end{aligned}\right\} \tag{10}$$

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Green functions method in the theory ... B102/B180

This system is easily solved for the case of a finite number of magnetic sublattices, i. e. translational symmetry of the spin system. It is demonstrated for (a) a ferromagnetic with one sublattice, (b) a ferromagnetic with two sublattices, and (c) a simple spiral.

ASSOCIATION: Institut fiziki metallov AN SSSR, Sverdlovsk (Institute of the Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: September 3, 1962

IZYUMOV, Yu.A.

Theory of the scattering of slow neutrons in magnetic crystals. (MIRA 16:3)
Usp. fiz. nauk 80 no.1:41-92 My '63.
(Neutrons--Scattering)
(Cryastals--Magnetic properties)

VONSOVSKIY, S.V.; IZYUMOV, Yu.A.

"Methods of Green's functions in statistical mechanics" by V.L. Bonch-Bruevich, S.V.Tiablikov. Reviewed by S.V.Vonsovskii, IU.A.Iziumov. Usp. fiz. nauk 81 no.2:403-405 O '63. (MIRA 16:12)

ACCESSION NR: AP4023381 S/0048/64/028/003/0406/0411

AUTHOR: Vonsovskiy, S.V.; Izyumov, Yu.A.

TITLE: Contribution to the theory of sd-exchange interaction in transition metals /Report, Symposium on Ferromagnetism and Ferroelectricity held in Leningrad 30 May to 5 June 1963/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.3, 1964, 406-411

TOPIC TAGS: electron interaction, sd-exchange interaction, indirect exchange interaction, superexchange interaction, transition metal magnetic moment, transition metal form factor, dilute alloy ferromagnetism, rare earth helicoid structure

ABSTRACT: A unified treatment is given of the following three problems involving interaction between localized and collectivized electrons in transition metals: indirect exchange interaction via the conduction electrons; the magnetic form factor of a transition metal ion; the effective magnetic moment of a transition metal ion. The Dirac operator for the sd-exchange interaction between the conduction and the bound electrons is expressed in the second quantization representation. The indirect exchange interaction is to be obtained from this by eliminating the creation and

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ACCESSION NR: AP4023381

and destruction operators a^{+}_{ks} and a_{ks} for the conduction electrons. This is accomplished approximately by averaging over the grand canonical ensemble. The indirect exchange interaction and the electron spin density are thus expressed in terms of the same correlator $\langle a^{+}_{k's'}, a_{k''s''} \rangle$, where the brackets indicate the average over the canonical ensemble. The correlator is evaluated by the two dimensional Green's function method of N.N.Bogolyubov and S.V.Tyablikov (Dokl.AN SSSR,126,53,1959). The integro-differential equation for the two dimensional Green's function is solved by iteration, and a perturbation series is obtained for the correlator. To evaluate the indirect exchange integral, it is assumed (for lack of information to the contrary) that the sd-exchange integral is independent of the momentum transfer. The indirect exchange integral is evaluated in closed form for the case that the conduction band is either thinly or densely populated, so that the free quasiparticle approximation can be employed for electrons or holes. The indirect exchange integral in this case is long range (inverse cube) and oscillatory. Indirect exchange of this type is responsible for ferromagnetism in dilute alloys and for the formation of helicoid structure in rare earth metals. If the conduction band is roughly half filled, the character of the indirect exchange interaction is entirely different, but no general conclusions can be drawn concerning it. The electron spin density about a transi-

ACCESSION NR: AP4023381

tion metal ion, and hence the magnetic form factor and effective spin of the ion, are determined by the same correlator that determines the indirect exchange interaction. Expressions are derived for the effective form factor and spin. With the aid of these formulas, conclusions can be drawn concerning the indirect exchange interaction from measurements of the form factor or the magnetic moment of transition metal ions. Orig.art.has: 26 formulas.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Physics of Metals, Academy of Sciences, SSSR)

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SUB CODE: PH	NR REF SOV: 005	OTHER: 003

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APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

L 00566-66 EWT(1)/T IJP(c) GG

ACCESSION NR: AP5016566 UR/0056/65/048/006/1723/1731

AUTHORS: Izyumov, Yu. A.; Medvedev, M. V.

TITLE: Some properties of a ferromagnetic crystal containing a magnetic impurity atom

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 48, no. 6, 1965, 1723-1731

TOPIC TAGS: ferromagnetic material, spontaneous magnetization, ferromagnetic resonance, crystal lattice structure, spin wave, crystal impurity

ABSTRACT: The rigorous mathematical treatment developed by the authors in an earlier paper (ZhETF v. 48, 574, 1965) is used to analyze certain effects due to the presence of local magnetic oscillations in a ferromagnetic crystal containing impurities at low temperatures. It is shown that if one of the local levels lies close

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to the bottom of the spin-wave band, then an anomaly should be observed in the temperature dependence of the spontaneous magnetization, which should decrease much faster than required by the $T^{3/2}$ law for an ideal crystal, even when the impurity concentration does not exceed a few per cent. Ferromagnetic resonance in such a crystal in a uniform radio-frequency field is also considered. It is shown that when the g-factors of the matrix and impurity atoms are different, the radio-frequency field can excite local oscillations of the s-type only. When the g-factors are equal, only the usual ferromagnetic resonance, with excitations of uniform spin precession, should be observed. Orig. art. has: 44 formulas.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Metal Physics, Academy of Sciences, SSSR)

SUBMITTED: 15Jan65 ENCL: 00 SUB CODE: SS

NR REF SOV: 003 OTHER: 002

Card 2/2

L 18775-66 EWT(l) IJP(c) GG
ACC NR: AP6002732 SOURCE CODE: UR/0056/65/049/006/1887/1894

AUTHORS: Izyumov, Yu. A.; Medvedev, M. V.

ORG: Institute of Metal Physics, Academy of Sciences SSSR (Institut fiziki metallov Akademii nauk SSSR); Ural State University (Ural'skiy gosudarstvennyy universitet)

TITLE: Peculiarities of the spin-wave spectrum of a ferromagnet containing impurities and the temperature dependence of spontaneous magnetization

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 6, 1887-1894

TOPIC TAGS: spin wave spectrum, ferromagnetism, magnetic resonance, spontaneous magnetization, impurity level

ABSTRACT: The conditions for the occurrence of virtual and local magnetic oscillations in a Heisenberg ferromagnet with simple cubic lattice, containing an impurity magnetic atom, are calculated by numerically solving an equation previously derived by the authors

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L 18775-66
ACC NR: AP6002732

(ZhETF v. 48, 574, 1965) for the density of states in the spin-wave spectrum. The energies of the local and virtual states are obtained from these equations by numerical means. Equations are presented for the conditions under which virtual and local levels are absent, the conditions under which virtual levels appear near the top of the band, and the conditions under which local levels appear. It is shown that only virtual levels of the s-type can arise at the bottom of the spin-wave band and only in those cases when the exchange coupling between the impurities in the atoms of the matrix is weaker than the exchange coupling between the matrix atoms themselves. Approximate formulas are also obtained for the density of states near the bottom of the band, and respectively for the spontaneous magnetization at low temperatures of a ferromagnet with an impurity. It is also shown that strong excitation of the impurity spins produces further decrease in the magnetization of the crystal, but this cannot be calculated correctly by means of the density of the single-particle states, and calls for a self-consistent solution of the equations for the magnetization of individual sites with the aid of temperature Green's function. The authors thank Ye. A. Turov and O. B. Sokolov for helpful discussions. Orig. art. has: 6 figures and 21 formulas.

SUB CODE: 20/ SUBM DATE: 05Jul65/ ORIG REV: 004/ OTH REF: 001

Card 2/2 MJS

ACC NR: AP6031443 SOURCE CODE: UR/0056/66/051/002/0517/0527

AUTHOR: Izyumov, Yu. A.; Medvedev, M. V.

ORG: Institute of the Physics of Metals, Academy of Sciences SSSR (Institut fiziki metallov Akademii nauk SSSR); Ural State University (Ural'skiy gosudarstvennyy universitet)

TITLE: Impurity atom in a ferromagnetic crystal with negative exchange interaction

SOURCE: Zh eksper i teor fiz, v. 51, no. 2, 1966, 517-527

TOPIC TAGS: impurity atom, spin wave theory, ferromagnetic material, matrix element, spin system, crystal property, temperature dependence

ABSTRACT: A spin wave theory is developed for a ferromagnetic cubic crystal containing an impurity atom which has a negative interaction with the matrix. It is shown that the ground state of such a crystal is magnetically inhomogeneous due to the zero oscillations of the spin system. This means that the impurity spin projection on the direction of the spontaneous moment is smaller than its maximum value, and the decrease is compensated for by a nonuniform contraction of the matrix atom

ACC NR: AP6031443

spins. It is shown that the effect is related to the s-type spin system oscillations (in the state terminology used for describing a crystal containing an impurity with ferromagnetic interactions). The temperature dependence of spontaneous crystal magnetization in the range of validity of the Bloch law is calculated and the corresponding results are compared with the case of a ferromagnetic impurity. Measurements of the saturation magnetization at zero temperature and the temperature dependence of the magnetization of a crystal containing a low impurity concentration permit the determination of the impurity atom spin and its exchange with the matrix. Orig. art. has: 54 formulas. [Based on authors' abstract]. [NT]

SUB CODE: 20/ SUBM DATE: 04Feb66/ ORIG REF: 006/ OTH REF: 003/

Card 2/2

L 04799-67 EWT(d)/EWT(1) WW

ACC NR: AP6024476 SOURCE CODE: UR/0181/66/008/007/2117/2123

AUTHOR: Izyumov, Yu. A.; Medvedev, M. V.

ORG: Institute of Metal Physics AN SSSR (Institut fiziki metallov AN SSSR); Ural State University im. A. M. Gor'kiy, Sverdlovsk (Ural'skiy gosudarstvennyy universitet)

TITLE: Temperature behavior of impurity spins in a ferromagnetic matrix

SOURCE: Fizika tverdogo tela, v. 8, no. 7, 1966, 2117-2123

TOPIC TAGS: spin wave, spontaneous magnetization, saturation magnetization, ferromagnetic structure, crystal impurity, Green function, temperature dependence

ABSTRACT: This is a continuation of earlier work (ZhETF v. 49, 1887, 1965), where a spin-wave theory was developed for a Heisenberg ferromagnet containing a magnetic impurity atom. In the present paper it is shown, using two-temperature Green's functions, that under certain conditions, when the exchange coupling between the impurity and the matrix is much weaker than the exchange coupling of the matrix atoms, the spontaneous magnetization of the impurity atom in the ferromagnetic crystal has a specific temperature dependence. It can become very small at temperatures at which the magnetization of the matrix atoms is still close to saturation. Such a behavior of the impurity spin is due to the existence in the elementary-excitation spectrum of a narrow resonance level lying at the bottom of the band of the quasicontinuous exci-

Card 1/2

ACC NR: AP7002732 SOURCE CODE: UR/0126/66/022/006/0801/0809

AUTHOR: Izyumov, Yu. A.; Medvedev, M. V.

ORG: Institute of Metal Physics, AN SSSR (Institut fiziki metallov AN SSSR); Ural State University im. A. M. Gor'kiy (Ural'skiy gosuniversitet)

TITLE: Neutron scattering in a ferromagnetic crystal containing impurities with negative exchange coupling

SOURCE: Fizika metallov i metallovedeniye, v. 22, no. 6, 1966, 801-809

TOPIC TAGS: ferromagnetic material, neutron scattering, spin wave, magnetic crystal, crystal impurity

ABSTRACT: This work is a continuation of a previous investigation (Izyumov, Yu. A., Medvedev, M. V. ZhETF, 1966, 51, 517) dealing with the spin-wave theory of a ferromagnetic crystal containing an impurity atom with negative exchange coupling with the matrix, with the difference that it deals with the theory of the inelastic scattering of neutrons in a ferromagnetic crystal containing a small concentration of impurity atoms with a spin and exchange integrals differing in value from those in the original crystal. (Owing to zero oscillations in the spin-system, the fundamental state of such a crystal is characterized by nonuniform distribu-

UDC: 669.017:539.125.5

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APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

ACC NR: AP7002732

tion of spin projections onto the direction of the spontaneous moment about the impurity atom. Then the spin projection of the antiferromagnetic aligned spin does not equal in absolute figures its maximum value S' and is somewhat shorter, this contraction being compensated by the overall spin contraction of the atoms of the matrix. An investigation of magnetic noncoherent elastic scattering of neutrons on such crystals in the presence of low impurity concentrations, in the small-angle region, makes it possible in principle to determine the form-factor of the nonuniform distribution of the magnetic moment in the neighborhood of the defect. An experimental determination of the inelastic neutron scattering cross sections in such a crystal would make it possible to investigate the structure of spin excitations in the crystal. Here, however, this question is investigated theoretically alone.) The case of negative exchange coupling between the impurity and the matrix is considered, with the impurity spin in the fundamental state being oriented in a direction antiparallel to the direction of the magnetic order of the matrix. Compared with the case of ferromagnetic impurity, neutron scattering in such a crystal displays a specific feature; the noncoherent part of the cross section has a sharp peak even at transition energies lying within the quasicontinuous spectrum region, because states of a special kind, whose excitation enhances the spontaneous moment of the crystal, participate in the scattering. Recording this peak makes it possible to determine the exchange integral impurity-matrix. Orig. art. has: 38 formulas.

SUB CODE: 20 / SUBM DATE: 13May66/ ORIG REF: [illegible]/ OTH REF: 001

Card 2/2

ACC NR: AP6037071 SOURCE CODE: UR/0056/66/051/005/1423/1429

AUTHOR: Izyumov, Yu. A.; Medvedev, M. V.

ORG: Institute of Physics of Metals, Academy of Sciences, SSSR (Institut fiziki metallov Akademii nauk SSSR)

TITLE: Incoherent scattering neutrons in a ferromagnet and the problem of reconstructing the magnon spectrum

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 51, no. 5, 1966, 1423-1429

TOPIC TAGS: neutron scattering, inelastic scattering, ferromagnetic materials, magnon, Green function, scattering cross section

ABSTRACT: A method is developed for determining the state density in the magnon spectrum of a ferromagnetic crystal from data pertaining to inelastic scattering of neutrons. The method is based essentially on reducing the problem to the calculation of the Green's function of the crystal containing one non-magnetic impurity. It is shown thereby that measurement of the scattered neutron energy distribution should not be carried out for a perfect ferromagnetic crystal, but for a crystal containing a small concentration of nonmagnetic substitution atoms. In this case the cross section defined by the incoherent single-magnon scattering impurities can be expressed in terms of the density state in the magnon spectrum of a perfect crystal. Although the concrete calculations are presented for a simple cubic lattice, they can be readi-

Card 1/2

AID P - 3819

Subject : USSR/Mining

Card 1/1 Pub. 78 - 7/25

Author : Izyumova, A. M.

Title : Trial introduction of hydraulic formation ruptures ("breakthroughs") in oil recovery operations in the Malgobek oil field

Periodical : Neft. khoz., v. 33, #11, 39-44, N 1955

Abstract : Description of the secondary recovery of oil in the Malgobek oil field (Checheno - Ingush, R.S.F.S.R.) by the method of hydraulic formation ruptures, i.e. raising the well input pressure above a level of a "breakthrough" to create cracks in the sand bodies and rocks. The fluid used was the reservoir oil mixed with quartz sand. The results were highly satisfactory. Diagram, charts.

Institution : None

Submitted : No date

shows the change in the fracture's sand content in relation to the applied volume of flushing fluid. The authors conclude that: 1) the sand filling up the horizontal fracture distributes itself in the form of a shoal where the sand lies as a tightly packed layer and in the form of channels where the sand lies in separate grains 2) the relationship between the shoal and channel areas is determined by the injection rate of the sand slurry, i.e., the greater the consumption, the larger the area occupied by the channels and the smaller the area of the shoals, 3) the degree of sand accumulation in the channels is determined by the sand content of the fracturing fluid, i.e., the higher the content, the more sand in the channels, 4) the application of flushing fluid following the sand injection results in washing the sand out of the channels and, consequently, in greater permeability of the fracture, 5) the flushing fluid must be used to an optimum limit and when this limit is exceeded the sand shifting in the fracture is discontinued, 6) the sand distribution in the fracture following flushing is determined by the fracturing fluid consumption and does not depend on the sand content of the fluid, and 7) viscous fracturing fluid injected at low injection rates results in the same sand distribution as the application of low viscosity fluid at high injection rates. There are 5 figures and 3 tables.

1. Petroleum--Production 2. Wells--Processing 3. Fluids--Injection 4. Sand--Properties

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

SOV/93-58-12-8/1

14(5)

AUTHOR: Shan'gin, N.N. and Izyumova, A.M.

TITLE: Sand Movement and Distribution in Vertical Fractures (Dvizheniye i razmeshcheniye peska v vertikal'noy treshchine)

PERIODICAL: Neftyanoye khozyaystvo, 1958, Nr 12, pp 36-[illegible] (USSR)

ABSTRACT: The movement and distribution of sand in horizontal fractures was described in an earlier article [Ref 1]. The present article presents experimental data on the movement and distribution of sand in a vertical fracture. The experiments were performed by the GrozNII Institute with the aid of a model (Fig 1) and the results are shown in Figs 2-4 and Table 1. They concluded that the sand movement and distribution in a vertical fracture is determined by the filtrability and viscosity of the sand transporting fluid and by the consumption of the fluid-sand mixture, that the sand distribution is more efficient when the volume of flushing fluid following the sand injection is equal to the volume of the fluid-sand mixture, and that the sand transporting fluid must be of such viscosity as to permit complete consolidation of the sand at the bottom of the fracture during the sand injection period. There are 4 figures, 1 table, and 1 Soviet reference.

Card 1/1

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

SHAN'GIN, N.N.; IZYUMOVA, A.M.

Reservoir water exclusion through the use of cement plugs.
Azerb. neft. khoz. 38 no.2:35-37 F '59. (MIRA 12:5)
(Oil well cementing)

SOTNIKOV, V.I.; IZYUMOVA, L.G.

Tungsten content in granites of typhons of the Gornyy Altai characterized by varying ore content. Geokhimiia no.2:175-179 F '65. (MIRA 18:6)

1. Institut geologii i geofiziki Sibirskogo otdeleniya AN SSSR, Novosibirsk.

LAYCHEVA, I.G.

Direct spectral determination of rare-earth elements in rocks and minerals using the DFS-13 spectrograph. [Trudy] Inst. geol. i geofiz. Sib. otd. AN SSSR no.34:34-40 '65. (MIRA 18:9)

Dissertation: "The Biology of Dactylogyrus vastator Nybolin and Dactylogyrus solidus Achmerow in Carp Culture." Cand Biol Sci, Inst of Zoology, Acad Sci USSR, Moscow, Oct-Dec 53. (Vestnik Akademii Nauk, Moscow, Jun 54)

SO: SUM 318, 23 Dec 1954

IZYUMOVA, N.A.

Materials on the method of studying specificities of monogenetic trematoda. Trudy Zool.inst. 13:155-159 '53. (MLRA 7:5)
(Trematoda) (Parasites--Carp)

IZYUMOVA, N.A.

Specificity of Dactylogyrus vastator and D.solidus with relation to their hosts. Parazit.sbor.16:217-228 '56. (MLRA 9:7)

1.Zoologicheskiy institut Akademii nauk SSSR.
(Trematoda) (Parasites--Fishes)

IZYUMOVA, N.A.

Data on the biology of Dactylogyrus vastator Nybelin. Parazit sbor.16: 229-243 '56. (MLRA 9:7)

1.Zoologicheskiy institut Akademii nauk SSSR.
(Parasites--Fishes) (Trematoda)

IZYUMOVA, N.A.; SHIGIN, A.A.

Parasites of fishes of the Volga River in the regions of Gorkiy and Kuybyshev Reservoirs. Trudy Biol. sta. "Borok" no.3:364-383 '58. (MIRA 11:9)

(Gorkiy Reservoir--Parasites--Fishes)
(Kuybyshev Reservoir--Parasites--Fishes)

IZYUMOVA, N.A.

Seasonal dynamics of the parasite fauna of fishes in Rybinsk Reservoir. Trudy Biol. sta. "Borok" no.3:384-398 '58. (MIRA 11:9)
(Rybinsk Reservoir--Parasites--Fishes)

Izyumova, N. A.

~~IZUMOVA, N. A.~~

"On the Seasonal Prevalence of Fish Parasites in the Ryelnsk Reservoir."

Tenth Conference on Parasitological Problems and Diseases with Natural Reservoirs, 22-29 October 1959, Vol. II, Publishing House of Academy of Sciences, USSR, Moscow-Leningrad, 1959.

Institute of the Biology of Water Reservoirs, Academy of Sciences of the USSR (Borok)

IZYUMOVA, N.A.

Some characteristics of the formation of the parasite fauna of fishes in new reservoirs. Trudy Inst. biol. vodokhran. no.1:324-331 '59. (MIRA 13:2)

(Parasites--Fishes) (Reservoirs)

IZYUMOVA, N.A.

Dynamics of the parasite fauna of fishes in Rybinsk Reservoir.
Trudy Inst.biol.vodokhran. no.2:174-190 '59.
(MIRA 13:5)

(Rybinsk Reservoir--Parasites)
(Parasites--Fishes)

IZYUMOVA, N.A.

Seasonal dynamics of the parasite fauna of fishes in Rybinsk Reservoir. Trudy Inst. biol. vodokhran. no.3:283-300 '60. (MIRA 14:3)
(Rybinsk Reservoir--Parasites) (Parasites--Fishes)

DOVGOPOL, S.P.; IZYUMOVA, T.G.

Spin diffusion of nuclei in double electron-nuclear resonance. Zhur.eksp. i teor.fiz. 49 no.5:1483-1491 N '65. (MIRA 19:1)

1. Ural'skiy politekhnicheskiy institut.

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SOV/126-8-6-1/24

AUTHORS: Zyryanov, P.S., Izyumova, T.G. and Skrotskiy, G.V.

TITLE: Electrical Conductivity of Ferromagnetic Metals in a Radio-Frequency Field

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 6, pp 801-806 (USSR)

ABSTRACT: It is well known that ferromagnetic metals have an additional resistivity due to the interaction of conduction electrons with thermal fluctuations in the magnetization. In the case of ferromagnetic resonance, the character of the magnetization fluctuations may be altered quite considerably. The resistivity of a metallic ferromagnetic may be looked upon as consisting of three components, namely those due to the interaction of the conduction electrons with phonons and ferromagnons, and a further component due to the change in the magnetization in a radio frequency field. The temperature dependence and the order of magnitude of the first of the above three components is well known. The second component has been calculated by Turov (Ref 1) for the low temperature region, using the spin wave model; the temperature dependence of this component is in a

Card 1/3

Izyumova, T. G.

PHASE I BOOK EXPLOITATION SOV/4893

Vsesoyuznoye soveshchaniye po fizike, fiziko-khimicheskim svoystvam ferritov i fizicheskim osnovam ikh primeneniya. 3d, Minsk, 1959

Ferrity; fizicheskiye i fiziko-khimicheskiye svoystva. Doklady (Ferrites; Physical and Physicochemical Properties. Reports) Minsk, Izd-vo AN BSSR, 1960. 655 p. Errata slip inserted. 4,000 copies printed.

Sponsoring Agencies: Nauchnyy sovet po magnetizmu AN SSSR. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR.

Editorial Board: Resp. Ed.: N. N. Sirota, Academician of the Academy of Sciences BSSR; K. P. Belov, Professor; Ye. I. Kondorskiy, Professor; K. M. Polivanov, Professor; R. V. Telesnin, Professor; G. A. Smolenskiy, Professor; N. N. Shol'ts, Candidate of Physical and Mathematical Sciences; E. M. Smolyarenko; and L. A. Bashkirov; Ed. of Publishing House: S. Kholyavskiy; Tech. Ed.: I. Volokhanovich.

PURPOSE: This book is intended for physicists, physical chemists, radio electronics engineers, and technical personnel engaged in the production and use of ferromagnetic materials. It may also be used by students in advanced courses in radio electronics, physics, and physical chemistry.

COVERAGE: The book contains reports presented at the Third All-Union Conference on Ferrites held in Minsk, Belorussian SSR. The reports deal with magnetic transformations, electrical and galvanomagnetic properties of ferrites, studies of the growth of ferrite single crystals, problems in the chemical and physicochemical analysis of ferrites, studies of ferrites having rectangular hysteresis loops and multicomponent ferrite systems exhibiting spontaneous rectangularity, problems in magnetic attraction, highly coercive ferrites, magnetic spectroscopy, ferromagnetic resonance, magneto-optics, physical principles of using ferrite components in electrical circuits, anisotropy of electrical and magnetic properties, etc. The Committee on Magnetism, AS USSR (S. V. Vonsovskiy, Chairman) organized the conference. References accompany individual articles.

Ferrites (Cont.) SOV/4893

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E032/E314

Effect of Electron Magnetic Resonance on the Optical Properties of Ferromagnetic and Paramagnetic Bodies

by Eq (5) is employed. It was shown in a previous paper (Ref 5) that Eqs (1)-(3) together with Eq (4) or Eq (5) take into account spin orbit interactions. In fact, the self-consistent field H_i is due to spin-spin and spin-orbit interactions. Eq (1) does not include the damping term but this has no fundamental effect on the final results. The change in the optical properties of solids in magnetic resonance, and in particular the resonance Faraday effect, may in the case of paramagnetic media be used to determine the longitudinal and transverse relaxation times $\tau_{\parallel}$ and $\tau_{\perp}$. It is shown that the relative change in the rotation of the plane of polarisation is given by Eq (25), while the width of the absorption line can be determined from Eq (26). Eq (25) is the same as the expression obtained by Daniels and Wesemeyer (Ref 6) by another method. Using experimental values for $\Delta\theta/\theta$ at resonance $(\Delta\omega = 0)$ and H_0, one can calculate $\tau_{\parallel}$ and $\tau_{\perp}$ (H_c is the constant magnetic

Card2/3

82990
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B006/B070

24.7900

AUTHORS: Skrotskiy, G. V., Izyumova, T. G.

TITLE: The Magneto-optical Kerr Effect in Ferromagnetic Substances Placed in a Radio-frequency Field

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 8, pp. 1739-1740

TEXT: In an earlier work (Ref. 1) the authors have developed a macroscopic theory to explain the observed effect of electron paramagnetic resonance on the optical Faraday effect. The method developed in Ref. 1 for the determination of the refractive index of non-conducting paramagnetic media in the presence of a radio-frequency field is, in the present work, extended to conducting ferromagnetic substances. This enables one to make an estimate of the effect of ferromagnetic resonance on the magnitude of the magneto-optical Kerr effect. This happens for the special case when the direction of propagation of the linearly polarized light wave, hitting perpendicularly the ferromagnetic mirror magnetized to saturation, coincides with the direction of the magnetizing field.

Card 1/2

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6, 3000 (1024, 1106)
6.4780

S/181/60/002/010/017/051
B019/B056

AUTHORS: Skrotskiy, G. V. and Izyumova, T. G.

TITLE: The Theory of the Optical Faraday-Effect in Ferrimagnetic Garnet Single Crystals in a Radiofrequency Field

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 10, pp. 2458-2460

TEXT: The authors first show that by increasing the amplitude of the highfrequency field up to values that correspond to the line width αH_0 of the ferrimagnetic resonance absorption, the angle of rotation θ of the plane of polarization of the light waves may be made zero. This would make possible a quick modulation of light intensity by changing the amplitude of the radiofrequency field. The paper by Dillon (Ref. 1) is then discussed, in which the rotation of the plane of polarization of light in thin plates made of rare earth ferrites was investigated. It is shown that here demagnetization must be taken into account, that is to say, in the equation for the magnetization of ferrimagnetics H_0 must be replaced by $H_0 - 4\pi M_z$. There are 1 figure and 6 references: 2 Soviet,

Card 1/2

35131
S/058/62/000/002/007/053
A058/A101

24.3500 (1137,1144)

AUTHOR: Izyumova, T. G.

TITLE: Relaxation effects in optically ordered spin systems

PERIODICAL: Referativnyy zhurnal, Fizika, no. 2, 1962, 43, abstract 2V347 ("Tr. Ural'skogo politekhn. in-ta", 1961, v. III, 24-31)

TEXT: There was carried out a quantum-mechanical derivation of equations of magnetization motion under conditions of optical pumping. It is shown that relaxation processes in such systems are due to two causes: Interaction within the spin system and between the spin system and the lattice, on the one hand, and interaction between the spin system and light radiation, on the other hand. There was obtained an expression for effective relaxation time τ. The dependence on incident-light intensity that was found for τ is consistent with experimental data (RZhFiz, 1959, no. 2, 3504).

U. Kopvillem

[Abstracter's note: Complete translation]

Card 1/1

SKROTSKIY, G.V.; IZYUMOVA, T.G.

Use of the phenomenon of optical orientation of atoms in the measurement of weak magnetic fields. Trudy Ural. politekh. inst. no.111:85-88 '61. (MIRA 16:6)

(Atoms) (Magnetic fields—Measurement)

89208

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B102/B204

Theory of double electron ...

Such an effect was observed for the first time by Feher and was qualitatively explained. (The saturation of the nuclear system leads to no noticeable polarization of the electron spins, whereby the conditions for the saturation of the electron system are changed and a change in the absorption of the energy of an r.f. field is caused by the electron system). The present paper gives a quantum-mechanical analysis of the effect produced by nuclear magnetic resonance upon paramagnetic resonance. Such an analysis cannot be carried out within the framework of the linear theory of magnetic resonance. The authors operate by means of the method of the statistical perturbation theory developed by Tomita. A system is studied which consists of non-compensated electron spins $\vec{s}^k$, which are near several nuclei with different moments $\vec{I}^l$. Between electrons and nuclei a scalar interaction is assumed, and also an interaction between electrons and lattice. The magnetic field in which the specimen is located, is assumed to be characterized by $\vec{H} = \vec{H}_o + \vec{h}_s(t) + \vec{h}_I(t)$, where $\vec{h}_s$ and $\vec{h}_I$ are the strengths of the microwave and the r.f. fields. These fields are assumed to be circularly polarized in a plane that is perpendicular to $\vec{H}_o$. The Hamiltonian of the system consisting of electrons and nuclei is set up as:

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B102/B204

Theory of double electron ...

$\hat{\mathcal{H}} = -g_s\mu_s \sum_k \hat{\vec{s}}^k\vec{H} - \sum_l g_I^l\mu_I^l\hat{\vec{I}}^l\vec{H} + \sum_{l,k} A_l\hat{\vec{s}}^k\hat{\vec{I}}^l + \hat{\vec{s}}\hat{\vec{F}} + \hat{\mathcal{H}}_F$, where μ_s and μ_I denote electron and nuclear magnetons respectively, A_l denoting the hyperfine interaction constant; the term $\vec{s}\vec{F}$ takes electron-lattice interaction $(\vec{s} = \sum\hat{\vec{s}}^k)$ into account, and $\hat{\mathcal{H}}_F$ is the operator of lattice energy. By the introduction of variables adapted to the problem, $\hat{\mathcal{H}}$ is transformed to scalar representation. It is further assumed that the energy of hyperfine interaction is low compared to the Zeeman energy of the electrons, in which case electron and nuclear spins precess independently around the strong constant field H_o, and the hyperfine interaction may be considered as a perturbation. In this case, the hyperfine interaction leads to an irregular broadening of the epr lines (Ref. 6), which, as the spin system is not in equilibrium, is also a function of time. On these assumptions, the equation of motion for the magnetization vector of the electron system is determined which, in first approximation (taking account of the terms linear in $\hbar\Omega_F/kT$) reads as follows:

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$$\frac{d}{dt}\langle \hat{M}^T\rangle = \frac{i}{\hbar}\langle [\hat{M}^T, \mathcal{H}_0^T]\rangle - i\sum_{\nu} a_{0\nu}(\vartheta)(\Phi_0 \mp \Psi_0)\langle [\hat{M}^T, \hat{s}_\nu]\rangle -$$
$$- \sum_{\mu\nu\nu'} a_{\mu\nu}(\vartheta) a_{-\mu\nu'}(\vartheta)\{(\Phi_{-\mu\nu'} \mp \Psi_{-\mu\nu'})\langle[[\hat{M}^T \hat{s}_\nu]\hat{s}_{\nu'}]\rangle +$$
$$+ \sum_{\mu\nu\nu'} a_{\mu\nu}(\vartheta) a_{-\mu\nu'}(\vartheta)\frac{\hbar\Omega_p}{kT}\Phi_{-\mu\nu'}\langle \hat{s}_{\nu'}[\hat{M}^T, \hat{s}_\nu]\rangle. \qquad (40)$$

This equation for vanishing hyperfine interaction goes over into the equation given by Tomita. By means of (40), the complex susceptibility and the saturation factor of the electron system are calculated:

In the steady state $M_x^T = \chi_s' h^s$, $M_y^T = \chi_s'' h^s$, $M_z^T = \chi_0 H_0 Z_s^{\mp}$ holds,

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B125/B201

AUTHORS: Skrotskiy, G. V., and Izyumova, T. G.

TITLE: Optical orientation of atoms and its applications

PERIODICAL: Uspekhi fizicheskikh nauk, v. 73, no. 3, 1961, 423-470

TEXT: The optical orientation of ions and atoms, which have magnetic moments in the ground state, may arise with selective absorption and the subsequent emission of light by these atoms and ions. This optical orientation may arise not only in beams, but also in vapors at reduced pressure. This opens a new way for the study of the structure of energy levels in the ground state and also in the excited states. Studies conducted later led on the one hand to the development of the method of optical orientation and to the elaboration of a theory of the phenomena accompanying the "optical pumping" (pompage optique). By this term one understands the following phenomenon: Irradiation of an assembly of atoms by light with the resonant frequency changes the type of filling of energy sublevels of the ground state of atoms: J. Brossel and A. Kastler

Card 1/11

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

of the ground state sublevels. Table V shows the resonant frequency as a function of the buffer gas pressure. Theoretical studies by R. H. Dicke are pointed out. IV. Phenomenological theory of the optical orientation of atoms. Equations for magnetization, effect of the radar frequency field upon the process of the orientation of atoms. The case of the "slow passage" according to Bloch is mentioned. V. Determination of the radar frequency resonance with the optical method. Determination of the constants of superfine structure, as well as of the g factors of nuclei and electrons. The energy spectrum of the atoms of alkali metals in a magnetic field, experiments on the study of radar frequency resonance with optical methods, multiquantum transitions, determination of the constants of hyperfine splitting. J. Brossel and F. Bitter were the first to study the 6^3P_1 state of mercury atoms by the optical method. VI. Practical applications of the method of optical orientation of atoms: Measurement of weak magnetic fields, determination of orientation in the space, standard of frequency determined by atoms. H. G. Dehmelt was the first to point to the possible use of the optical orientation of atoms

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B125/B201

Optical orientation of atoms...

and 75 non-Soviet-bloc. The three most recent references to English-language publications read as follows: T. L. Skillman, Intern. Hydrograph. Rev. 37, 107 (1960), F. D. Colegrove, P. A. Franken, Phys. Rev. Lett. 4, 548 (1960), T. H. Maiman, Phys. Rev. Lett. 4, 564 (1960).

Card 5/11

L 15667-66 EWT(m)/T

ACC NR: AP6000205 SOURCE CODE: UR/0056/65/049/005/1483/1491

AUTHORS: Dovgopol, S. P.; Izyumova, T. G.

ORG: Ural Polytechnic Institute (Ural'skiy politekhnicheskiy institut)

TITLE: Nuclear spin diffusion in electron-nuclear double resonance

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 49, no. 5, 1965, 1483-1491

TOPIC TAGS: nuclear resonance, electron spin resonance, ~~physical diffusion~~, spin system, correlation function, paramagnetic relaxation

ABSTRACT: The authors analyze electron-nuclear double resonance in a system with hyperfine interaction, and calculate the dispersion and absorption of the electron system in the presence of nuclear spin diffusion. It is assumed that spin diffusion is the mechanism whereby the excitation is transferred from the remote nuclei to the paramagnetic centers. The correlation function of the nuclear system is calculated for this relaxation mechanism. The corrections to the relaxation times of the electron system, due to spin diffusion, are found. The susceptibility of the elec-

ZIN'KOVSKIY, Abram Isaakovich; IZYUMOVA, T.I., red.; MATVEYEV, G.I., tekhn.red.

[Traveling-wave and backward-wave tubes] Lampy begushchei i obratnoi volny. Moskva, Gos.energ.izd-vo, 1959. 31 p. (Massovaia radiobiblioteka, no.331) (MIRA 12:11)
(Traveling-wave tubes) (Electron tubes)

IZYUMOVA, Tamara Ivanovna; SVIRIDOV, Vladimir Timofeyevich; KUZNETSOV, V.A., red.; LARIONOV, G.Ye., tekhn.red.

[Hollow and ribbon wave guides] Polye i lentochnye radiovolnovody. Moskva, Gos.energ.izd-vo, 1960. 95 p. (Massovaia radiobiblioteka, no.379). (MIRA 14:3)

(Wave guides)

LYUBIMOVA, Ye.N.; KUZ'MINA, Z.D.; IZYUMSKAYA, K.P.; KOMAROV, F.P.

Determining the degree of cellulose polymerization for production control. Bum. prom. 32 no.10:7-10 O '57. (MIRA 11:1)

1. TSentral'nyy nauchno-issledovatel'skiy institut tsellyuloznoy i bumazhnoy promyshlennosti.
(Woodpulp) (Polymerization)

KOMAROV, F.P.; KUZ'MINA, Z.D.; IZYUMSKAYA, K.P.

Changes of some characteristics of cellulose during oxidation. Trudy LTA no.91:89-94 '60. (MIRA 15:12)

1. TSentral'nyy nauchno-issledovatel'skiy institut tsellyuloznoy i bumazhnoy promyshlennosti.
(Cellulose) (Oxidation)

[illegible]

PETRISHCHEVA, P. A. and IZY[illegible]SKAYA, [illegible] "On the breeding places of [illegible] in Turkmenistan", In the collection: Voprosy krayevoy, o[illegible] i eksperim. parazitologii, Vol. 17, Moscow, 1949, p. 11[illegible]-29, - Biblio: 2[illegible] items.

SO: U-4393, 19 August 53, (Letopis 'Zhurnal 'nykh Statey', No. 22, 1949).

ALEKSEYEV, B.I., kand.tekhn.nauk; IZYUMSKIY, F.P., inzh.; YANKELEVICH, V.M., inzh.

Automatic regulator of the density of mold ramming. Mashinostroenie no.4:49-52 Jl-Ag '63. (MIRA 17:2)

1. Ukrainskiy institut metallov.

ALEKSEYEV, B.I., kand.tekhn.nauk; IZYUMSKIY, F.P., inzh.

Automatic control of air flow to blast-furnace tuyeres. Mekh.i avtom.proizv. 15 no.10:47-49 O '61. (MIRA 14:10)
(Blast furnaces--Equipment and supplies)
(Electric controllers)

MASLENNIKOV, N.D., kand.tekhn.nauk; MYSHONKOV, N.I., kand.tekhn.nauk; ALEKSEYEV, B.I., kand.tekhn.nauk; SHUMOV, Ye.N., inzh.; MASLOV, A.A., inzh.; YANKELEVICH, V.M., inzh.; IZYUMSKIY, F.P., inzh.

Investigating gas saturation of cast iron smelted in a cupola furnace. Mashinostroenie no.6:33-36 N-D '62. (MIRA 16:2)
(Cast iron--Defects)

IZYUMSKIY, N.A.; LEBEDEV, A.S.; VARGANOVA, A.N., redaktor; PETROVSKAYA, Ye., tekhnicheskiy redaktor.

[Collection of rules and instructions on boiler inspection] Sbornik pravil i rukovodiashchikh materialov po kotlonadzoru. Moskva, Izd-vo Ministerstva kommunal'nogo khoziaistva RSFSR, 1954. 438 p.
(Boilers--Inspection) (MIRA 8:1)

T[illegible]ASKI[illegible] [illegible]A

IZYUMSKIY, N. A.

AID P - 1973

Subject : USSR/Electricity

Card 1/1 Pub. 29 - 22/25

Author : Izyumskiy, N. A.

Title : Cleaning water heating boilers from scale

Periodical : Energetik, 4, 38-39, Ap 1955

Abstract : In reply to a question from a reader, the author briefly describes chemical treatment of scale in boiler cleaning.

Institution: None

Submitted : No date

91-58-6-9/39

AUTHOR: Izyumskiy, N.A., Engineer

TITLE: Damage to "Sampo" Locomobile Boilers (Povrezhdeniya kotlov lokomobiley "Sampo")

PERIODICAL: Energetik, 1958, Nr 6, pp 11 - 12 (USSR)

ABSTRACT: Damage was sustained by a number of locomobiles installed in various undertakings. Among the causes of the cracks was vibration due to defective shaft centering and airpump assembly and also the incorrect mounting of the boiler on its supports, so that the connection plates welded to the boiler bear the stress from the weight and vibration of the boiler. The author recommends that greater attention be paid to these points during locomobile operation. There is 1 figure.

AVAILABLE: Library of Congress

Card 1/1 1. Boilers-Damage 2. Boilers-Vibration 3. Boilers-Repair

IZYUMSKIY, N.A.; LEBEDEV, A.S.; ALTUF'YEVA, A.M., red.izd-va; VOLKOV, S.V., tekhn.red.

[Symposium of rules and regulations pertaining to boiler inspection] Sbornik pravil i rukovodiashchikh materialov po kotlonadzoru. Izd.3., ispr. i dop. Moskva, Izd-vo M-va kommun.khoz.RSFSR, 1959. 621 p. (MIRA 13:4)

(Boiler inspection)

IZYUMSKIY, N.A., inzh.

Breakage of cast-iron fittings in steam suppy lines. Bezop.truda v prom. 7 no.7:16-17 Jl '63. (MIRA 16:9)

1. Upravleniye Moskovskogo gorodskogo okruga Gosudarstvennogo komiteta pri Sovete Ministrov RSFSR po nadzoru za bezopasnym vedeniyem rabot v promyshlennosti i gornomu nadzoru.
(Steampipes)

Reforestation

Reestablishing of forest planting in the steppe. Les. khoz. 4, no. [illegible], 1951

Monthly List of Russian Accessions. Library of Congress, April 1952. UNCLASSIFIED.

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

IZYUMSKIY, P. P.

Sosstanovlenie kholkhoznykh lesov i ukhod za nimi /Restoration of collective farm forests and their upkeep/. Kiev, Gossel'izdat, USSR, 1952. 77p

SO: Monthly List of Russian Accessions, Vol 6 No 8 November 1953

Izyumskiy, P.P.

USSR/Forestry - Biology and Typology of the Forest. K-2

Abs Jour : Ref Zhur - Biol., No 3, 1958, 10568

Author : Izyumskiy, P.P.

Inst : Khar'kov Agricultural Institute

Title : The Effect of Pruning Branches and Removing Brushwood on the Condition of Certain Tree Species.

Orig Pub : Zap. Khar'kovsk. s.-lh. i-ta, 1955, 10 (47), 33-39.

Abstract : Between 1938 and 1952 a study was made of the effect of pruning branches and of the natural and artificial removal of underbrush upon the functioning of physiological and biochemical processes. The study was conducted under various soil and climatic conditions in the Ukraine and in plantations which varied both in composition and in development. During the last five years the photosynthesis intensity; respiration and transpiration intensity, and the

Card 1/2

Abs Jour : Ref Zhur - Biol., No 2, 1958, 5919

Author : Izyumskiy, P.P.

Inst : -

Title : Rectification of Low Value Forests of the Wooded Steppe of the UkSSR.

Orig Pub : Lesnoye kh-vo, 1956, No 5, 32-42

Abstract : A series of measures is recommended for the rectification of those plantations in the woods of the UkSSR which have either been created unsuccessfully or subsequently damaged. Eight schemes of fundamental measures for various types of forest (in the Pogrebnyak) are advanced with the object of growing highly productive groves in which there will be oak, ash, types of maple, walnut, larch, pine, and other valuable species.

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4-5, it is proposed to begin purifying of the main species and to repeat it every 2-3 years; in the absence of main species in the rooted saplings, purifying is recommended in green leafy forests

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FEDORENKO, S.I., otv. red.; BYALLOVICH, Yu.P., nauchnyy sotr., red.; VOROB'YEV, D.V., red.; IZYUMSKIY, P.P., nauchnyy sotr., red.; KOBEZSKIY, M.D., red.; KUCHERYAVYKH, Ye.G., red.; LAVRINENKO, D.D., red.; NEDASHKOVSKIY, A.N., red.; PYATNITSKIY, S.S., red.; SAKHAROV, N.P., red.; SHCHEPOT'YEV, F.L., red.; MASLOBOYSHCHIKOVA, A.S., red.; POTOTSKAYA, L.A., tekhn. red.

[Sheltered zone of the Dnieper] Zashchitnaia zona Dnepra. Kiev, Izd-vo UASKhN, 1962. 191 p. (MIRA 16:4)

1. Kharkov. Ukrains'kyi naukovo-doslidchyi instytut lisovoho hospodarstva i agrolisomelioratsii. 2. Ukrainskiy nauchno-issledovatel'skiy institut lesnogo khozyaystva i agrolesomelioratsii (for Byallovich, Lavrinenko, Izyumskiy).
(Dnieper Valley--Windbreaks, shelterbelts, etc.)

[illegible], Pavel Pavlovich; DERYABIN, D.I., red.

[Methods for renovating poor forest stands] Metody obnovleniia malotsennykh nasazhdenii. Moskva, Lesnaia promyshlennost', 1965. 151 p. (MIRA 18:10)

IZYUMTSEV, [illegible], inzh.

Forging and pressing machine units. Mashinostroenie no.4:
111-112 Jl-Ag '64. (MIRA 17:10)

MARKOVICH, B.N., kand. tekhn. nauk, [illegible]TYUMTSEV, A.N., inzh.; [illegible], [illegible], inzh.

Manufacturing panels on punching presses. [Nauch. trudy] ENIKMASha 11:14-49 '65. (MIRA 18:6)

APPROVED FOR RELEASE: 08/10/2001 CIA-RDP86-00513R000619410017-2"

IZYUMTSEV, A.N., inzh.

The RA-41P punch press with a turret head. Mashinostroenie no.3:49-51 My-Je '63. (MIRA 16:6)

AUTHORS: Polivanov, V.V., Il'in, V.V. SOV/48-23-4-4/21
Iz"yurov, A.V., Pyatakov, N.I., Shumova, R.V.

TITLE: The Feeding Installation of Electron Microscopes UEMB-100 (Pitayushcheye ustroystvo elektronnogo mikroskopa UEMB-100)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1959, Vol 23, Nr 4, pp 450 - 453 (USSR)

ABSTRACT: First, mention is made of the investigation carried out by Leisegang (Ref 1), and it is pointed out that the requirement in electron microscopes with voltages as high as 100 kv of not allowing voltage and current fluctuations at the lenses to exceed 14.10^{-3} % can be met only by electronic stabilization of the current source. Figure 1 shows the block diagram of the apparatus. The electromagnetic stabilizer SNE-220-0,5 is made use of in the scheme. The lens current is electronically stabilized, its fluctuation amounting to 0.001%. The number of ampere turns of all lenses can be varied in a wide range. The selenium rectifiers for the high voltage of 100 kv allow a load of 120μA, the electronic stabilization of this high voltage occurs through

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anode tubes of the type 6Kh6S. Here as well, voltage fluctuation amounts to 0.001%. A description follows of the current supply into the vacuum cell of the instrument. Figure 4 shows the scheme of the focusing electrode of the electron accelerator, in which a diode of the type 2D9S is used. Finally, the present paper deals with the mechanical construction of the current source, the insertion into the whole instrument, and its applicability. There are 6 figures and 3 references, 1 of which is Soviet.

Some Problems Concerning the Calculation and Construction of the Supply System of Electron Microscopes

circuit diagrams for the high-voltage stabilization are shown in figure 1a, 1b. In the case of the first one, the authors attempted to obtain stabilization by means of voltage divider, and with a pentode in the second case. The direct current high voltage is doubled and rectified after having passed a 50 kv transformer by means of high-voltage rectifiers and condensers and the hum voltage is [illegible] by filter chains. The stabilization of the lens current is then discussed and explained by the aid of two circuit diagrams. A special problem is the heating of the lens coils. The diagram in figure 7a shows the effect of the structural variations by describing the temperature course, with respect to time, of the casing and the variation, with respect to time, of the lens winding [illegible] of the microscope UEM-100. The diagram in figure 7b shows the variation, with respect to time, of the temperature of the casing and of the lens winding resistance of the microscope UEMB-100; the result is a considerable improvement. To [illegible] in all Russian electron microscopes, the electric system is sheltered in the support, with the exception of the high

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E192/E382

AUTHORS: Polivanov, V.V., Il'in, V.V., Izbyurov, A.V., Pogudina, R.V. and Pyatakov, N.I.

TITLE: Power-supply Equipment for the Electron Microscope, Type УЭМВ-100 (UEMV-100)

PERIODICAL: Pribory i tekhnika eksperimenta, 1960, No. 5, pp. 147 - 151

TEXT: The new electron microscope, type UEMV-100 (Ref. 3), and its power supplies can be regarded as a further development of the microscope type УЭМБ-100 (UEMB-100). In particular, the high voltage supplies have the same three stages, i.e. 50, 75 and 100 kV and the lenses operate with the same number of ampere-turns. However, the new microscope is provided with improved power supplies. All the five lenses of the microscope are supplied from current stabilisers which are based on a single-stage circuit in which the anodes of the amplifier tubes are fed from a stabilised source. In this way, an increased stability of the lens currents was achieved. A further increase in the stability was secured by employing new tubes, types 6Н13С (6N13S) and 6С18С (6S18S). The use of the new
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E192/E382

Power-supply Equipment for the Electron Microscope, Type UEMV-100

tubes permitted the successful solution of a number of problems such as achieving a wide control of the lens currents, which is necessary for various operating conditions of the microscope. The mains voltage (220 V) is first stabilised by means of two series-connected ferroresonant stabilisers (Fig. 2). Small batteries, type 70-АМЦГ-У-1,3 (70-AMTsG-U-1.3) having a useful life of 15 months, are employed in the rectified stabilised supply sources. The supply sources for the lenses are provided with stepwise voltage control, which is achieved by means of multiple switches. Constructionally, the switches are assembled in blocks, each consisting of 3 wafers. Each wafer is provided with 23 contacts and has an independent control knob. The problem of providing the supply to the stigmators was solved in a novel manner (Fig. 3). Instead of using a number of rectifiers, a common rectifier, giving 300 mA, is used for all the stigmators. 5 potentiometers corresponding to the number

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Card 3/4

IZ"YUROV, A.V.

Instrument for measuring the instability of high voltage. Prib. i tekh. eksp. 6 no.2:122-124 Mr-Ap '61. (MIRA 14:9)
(Voltmeter)

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L 36339-66 EWT(m)/T/EWP(t)/ETI IJP(c) JD

ACC NR: AP6015780 (A, N) SOURCE CODE: UR/0048/66/030/005/0843/0845

AUTHOR: Iz"yurov, A. V.; Pogudina, R. V.; Polivanov, V. V.

56

ORG: none

TITLE: Problems involved in regulation of the accelerating potential of a high-resolution electron microscope /Report, Fifth All-Union Conference on Electron Microscopy held in Sumy 6-8 July 1965/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 30, no. 5, 1966, 843-845.

TOPIC TAGS: voltage stabilization, voltage regulator, electron accelerator, electron microscopy, electron microscope/EMV-150 electron microscope

ABSTRACT: The authors very briefly discuss the problems encountered in their attempts to regulate the 100-150 kV accelerating potential of a type EMV-150 electron microscope. The accelerating potential was developed with a high frequency oscillator and rectifier unit. Regulation was accomplished with the aid of a 1000:1 wire-wound voltage divider (not described), a battery-supplied reference voltage, and a dc amplifier (gain, 2500) which controlled the screen voltage of the oscillator tubes. Some possible sources of instability are enumerated and the contributions of some of them to the over-all instability are evaluated. It was found to be unnecessary to employ mercury-zinc cells for the reference voltage battery, selected manganese-zinc cells

IZ"YUROV, L.V., inzh.

Erecting arresters on the roof of the machine room of a hydroelectric power station. Prom.stroi. 41 no.3:40-41 Mr 64. (MIRA 17:3)

VINOGRADOV, L.N., mashinist; IZYUROV, M.Ya., mashinist.

Using recuperation of electric power without inverters located at substations. Elek. i tepl. tiaga 2 no.3:25 Mr '58. (MIRA 11:4)

1. Depo Sverdlovsk-Sortirovochnyy.
(Electric railroads--Substations) (Electric locomotives)

IZ'YUROV, V. A.

USSR/City Transportation 4602.0209 Apr 1947
City Planning 5108.0500

"Some Factors Affecting the Choice of Public Transportation Systems To Be Used in Soviet Cities," V. A. Iz'yurov, Candidate in Technical Sciences and Deputy Chm of Association for City Electric Transport, 5½ pp

"Vest Inzher i Tekh" No 5

Discusses projects planned for new Five-Year Plan, which, according to 1938 prices, would require some 1,825 million rubles. Discusses types of roadbeds, power feed, and cost of operating public transport systems. Author states that at peak load these systems should be capable of carrying some 40 - 50 thousand passengers per hour in one direction.

LC 12054

USSR/City Transportation 4602.0209 (Contd) Apr 1947

Installation of trolley-buses is feasible only where passenger demand would not exceed 5 - 15 thousand people per hour and only in event that electrical wiring has already been set up.

LC 12054

12054

[illegible], [illegible] A.

35417. Uproshchenie Raschetov [illegible] Elektrotyagovoy Mekhanike. Nauch. Trudy (Akad. Kommunal. Khoz-va Im. Panfilova), Vyp. 4-[illegible], 19[illegible], S. 7-1[illegible]

SO: Letopis' Zhurnal'nykh Statey, Vol. 34, Moskva, 19[illegible]

IZ'YUROV, V. A.

IZ'YUROV, V.A.; SURGUCHEV, V.D., redaktor.

[Calculations of traction for municipal electric transport systems; motorcars, trolley buses, and electromobiles] Tiagovye raschety gorodskogo elektrotransporta; motornye vagony, trolleibusy i elektromobili. Moskva, Izd-vo Ministerstva kommunal'nogo khoziaistva RSFSR, 1952. 231 p. (MIRA 7:8)
(Electric railroads) (Trolley buses)

GALONEN, Yu.M., kandidat tekhnicheskikh nauk.

"Calculations of traction in urban electric transportation."
V.A.Iz"yurov. Reviewed by IU.M.Galonen. Elektrichestvo no.1:94-95
Ja '54. (MLRA 7:2)
(Iz"iurov, V.A.) (Electric railway motors)

IZ"YUROV, V.A., kandidat tekhnicheskikh nauk.

Atomic-powered locomotive. Elektrichestvo no.7:92-93 Jl '56. (MLRA 9:10)

(Atomic locomotives)

IZ"YUROV, V.A., kand. tekhn. nauk.

Use of electric power in agriculture. Elektrichestvo no.12:85-88 D '56. (MIRA 11:3)

(Electricity in agriculture)

IZ'YUROV, V.A., kandidat tekhnicheskikh nauk.

Electrical household equipment abroad. Elektrichestvo no.3:86-88 Mr. '57. (MLRA 10:4)
(Austria--Electrical apparatus and appliances, domestic)

IZYUROV, V.V.

Selecting water drainage systems and pumps for deep Kizel Basin mines. Nauch. trudy PermNIUI no.5:31-42 '63. (MIRA 18:3)